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ABSTRACT

The University Macro Analytic Simulation System (UMASS) has been designed as a forecasting tool to help university administrators budgeting decisions. Alternative budgeting strategies can be tested on a computer model and then an operational alternative can be selected on the basis of the most desirable projected outcome. UMASS uses readily available input data in forecasting and provides on-line displays to enable rapid evaluation of simulated strategies. Hard copy reports provide detailed evaluation of the impact on every university unit plus a file copy for future use. The model is flexible and a decision maker with no programing experience and minimal preparation can execute a simulation and see the results immediately. (CH)

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21st Annual College and University Machine Records Conference

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"University Macro Analytic Simulation Model"

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CUMREC '76

University of Cincinnati / Miami University May 17,18,19 1976

Southwestern Ohio
Regional Computer Center

IR 003 591

UNIVERSITY MACRO ANALYTIC SIMULATION MODEL

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INTRODUCTION

University administrators annually face the difficult task of budgeting. In these times of stringently limited funds and increasing demands, the proper allocation becomes more and more critical. Since desisions have to be reached in current year for events occurring in a succeeding year, where the real effects might be delayed even further, forecasting becomes an absolute necessity. The crucial difference between fortune-telling (crystal ball method) and forecasting (use of past data and rigorous forecasting methods) becomes critical. University Macro Analytic Simulation System (UMASS) was designed as a forecasting tool to enable its users to play a "what if" game, where alternative strategies can be tested on a computer model and then an operational alternative can be selected on the basis of the most desirable projected outcome. This technique has been available for sometime, however its implementation has faltered in most cases.

DESIGN CRITERIA

UMASS was designed to be useful to decision makers on a University campus. This meant that the input data had to be readily available, not specially calculated for the model. Also the data had to be meaningful for the users who would evaluate the results or be effected by them. Departmental data which is used for input, is both available in annual budget documents and meaningful to department heads, deans and higher administrators. In order to limit the burden of data input and reduce the amount of output a compromise had to be achieved between need for detail and brevity.

Model outputs had to satisfy two criteria if they were to fulfill the needs of decision makers. First the model had to provide on-line displays to enable a quick evaluation of the strategy currently simulated. Second, once a strategy was chosen as a feasible one, hard-copy reports had to be produced for detailed evaluation of the impact on every unit plus a file copy for future reference.

Last but not least the model had to be flexible and easily executed, such that a decision maker with no programming experience and minimal preparation can execute it and see the results in minutes.

These design criteria were achieved by incorporating the following unique features into the model:

1). Two separate data bases.

One data base contains the data fed in by departments and is only used as input from then on. Changes are made to this data only if an error in source data is discovered. This feature insures that no error in the source data will be caused by any malfunction or incorrect operation of the model.

The second data base is a dynamic one, initiated by the source data base or by a previous run data base. This feature enables the model to use initial data, modify it by planning parameters and project it for the forecasting horizon. This data base is then used for producing the output reports in an interactive mode.

2). Flexible - dynamic planning parameters.

For each type of input variable there exists a planning vector that forecasts the changes in that variable's values for the planning horizon. These planning vectors can be used for all units with or without modification, by creating a so-called "planning matrix". Once created individual planning vectors for individual departments can be modified if desired. In addition planning parameters can be modified in a global mode if needed. These features enable the user to modify variables in an interactive mode by either units, aggregates or in a global mode. Once satisfactory, the planning matrix is applied to the data base to generate an alternative set of outcomes.

3). Iterative run mode.

After each run the current (dynamic) data base that evolved thru the application of the planning parameters is saved. Before a succeeding run the user is given the option of starting out with the previous (dynamic) data base. This enables the user to accumulate planning changes on top of previous planning changes to observe the effect of various strategies. Naturally the source data base can be selected any time and this destroys the last existing dynamic data base.

4). Interactive - selective output reports.

The model automatically displays an aggregate one page summary report to indicate run completion and enable a quick check of the general outcome. Summary data on all units for all peri-

ods and variables is produced automatically in a batch mode. This report can optionally be printed on a high speed line printer. If the summary report seems acceptable the report display program enables the user to select any number of reports in a menu-selection mode. Since the results are stored in a four dimensional matrix (by units, levels, variables and periods) the displays are generated by selecting values for two of the parameters and the appropriate two dimensional matrix, thus specified, is then displayed. This way the user can immediately focus on areas of special interest without having to wade through unnecessary data.

INPUT AND OUTPUT

1. Academic Model

The input variables used in the academic model were limited to:

4 personnel categories, namely numbers of faculty, teaching assistants, professionals (technicians, etc.) and classified employees (clerical such as secretaries).

5 expense categories of average annual salaries of the above listed categories of faculty, teaching assistants, professionals and classified employees. The fifth category is that of departmental support expense.

7 program variables to describe the nature of the unit i.e.:
- Student credit hours (undergraduate and graduate)
- Course credit hours (undergraduate and graduate)
- Average student load (undergraduate and graduate)
- Relative faculty effort.

In addition to producing summaries and averages of the input variables the following outputs are calculated:

Enrollment measures:

- Number of Instructional Full Time Equivalent Students
- Average class size
- Average faculty load

Cost measures:

- Total personnel $
- Total $

Cost indecies:

Instructional cost index per student credit hour
Instructional cost index per full-time equivalent student

Relative measures:

Student faculty ratio
Instructional support $ per student credit hour
Departmental support $ per faculty
Number of classified employees per faculty
Number of teaching assistants per faculty

Figure 1 shows a sample summary report of the academic model.

2. Administrative Model

According to the above criteria, however with different users in mind, the administrative model uses the following variables:

4 personnel categories, namely the numbers of staff in faculty, professional (managerial and administrative), clerical (secretarial) and technical (trade) categories.

7 expense categories, namely 4 payroll costs for the groups named above plus costs in 3 budget categories that contain part time salaries in the first, resource expenses in the second and support costs in the last.

In addition to producing summaries and averages of the input variables, the following outputs are produced:

Payroll costs of:
- Faculty
- Professionals
- Clerical personnel
- Technical personnel

Cost of:
- Total Professional (Faculty & Professional) Payroll
- Total Classified (Clerical & Technical) Payroll
- Total Personnel Payroll
- Total Other (other 3 budget categories)
- Grand Total

Figure 2 shows a sample summary report of the administrative model.

DIVISION OF AMHERST

SUMMARY LEVEL

PERIOD=	1974-75	1975-76	1976-77	1977-78	1978-79
NUMBER OF PERSONNEL					
FACULTY	1564.0	1407.6	1407.6	1407.6	1407.6
T.A.	503.0	452.7	452.7	452.7	452.7
PROFESSNL.	67.5	60.8	60.8	60.8	60.8
CLASSIFIED	429.4	386.5	386.5	386.5	386.5
AVG. ANNUAL SALARY					
FACULTY	21195.	21831.	22486.	23160.	23855.
T.A.	3600.	3600.	3600.	3600.	3600.
PROFESSNL.	22039.	22700.	23381.	24082.	24805.
CLASSIFIED	7873.	8109.	8353.	8603.	8861.
ENROLLMENT STATISTICS					
INSTR. FTE	22519.	22037.	22214.	22393.	22573.
STUDENT CH	656385.	642162.	647304.	652498.	657743.
COURSE CH	26995.	26280.	26478.	26679.	26881.
REL.FAC.EF	.61	.61	.61	.61	.61
AVG.CLASS	24.32	24.44	24.45	24.46	24.47
AVG.FAC.LD	17.26	18.67	18.81	18.95	19.10
AVG.STU.LD	29.15	29.14	29.14	29.14	29.14
$ COSTS					
SUPPORT $	2183402.	1965064.	1965066.	1965068.	1965070.
TOT.PERS.$	39828178.	36871906.	37929246.	39018309.	40140045.
TOTAL $	42011580.	38836970.	39894312.	40983377.	42105115.
INSTRUCTIONAL COST INDECIES					
ICI/SCH $	40.20	37.96	38.66	39.37	40.10
ICI/IFTE $	1171.74	1106.12	1126.40	1147.14	1168.35
MEASURES VS. NO. OF FACULTY					
STU/FAC	14.40	15.66	15.78	15.91	16.04
INST.SUP.$	2.03	1.87	1.86	1.84	1.83
DSE/FAC $	1396.	1396.	1396.	1396.	1396.
CLAS/FAC	.27	.27	.27	.27	.27
T.A./FAC	.32	.32	.32	.32	.32

Figure 1.

Summary Display of the Academic Model.

CAMPUS OF AMHERST

PERIOD=	1974-75	1975-76	1976-77	1977-78	1978-79
		NUMBER OF PERSONNEL			
FACULTY	1570.2	1558.9	1553.4	1593.5	1672.4
PROFESS'NL	412.7	410.5	409.4	415.0	426.4
CLERICAL	1190.3	1164.9	1152.7	1162.4	1201.3
TECHNICAL	681.0	681.0	681.0	681.0	681.0
		AVG.ANNUAL SALARY			
FACULTY	21014.	18899.	20970.	21590.	22668.
PROFESS'NL	18123.	16300.	18088.	18627.	19564.
CLERICAL	7940.	7150.	7939.	8177.	8580.
TECHNICAL	8646.	7781.	8637.	8896.	9341.
		PAYROLL COSTS			
FACULTY	32996311.	29460798.	32574890.	34404647.	37910454.
PROFESS'NL	7479271.	6690987.	7405336.	7729489.	8342394.
CLERICAL	9450648.	8329388.	9151073.	9504218.	10307054.
TECHNICAL	5887632.	5298870.	5881747.	6058200.	6361112.
		$ COSTS			
03 $	5385631.	4840042.	5368676.	5666114.	6202653.
04-09 $	3648927.	3283356.	3644162.	3756125.	3949403.
10-16 $	5774668.	5180986.	5742193.	6009541.	6498514.
TOT.PROF.$	40475582.	36151784.	39980226.	42134136.	46252048.
TOT.CLAS.$	15338280.	13628267.	15032819.	15562418.	16668166.
TOT.PERS.$	55813862.	49780052.	55013045.	57696554.	62921013.
TOT.OTHR.$	14809226.	13304385.	14755032.	15431780.	16650570.
TOTAL $	70623088.	63084437.	69768077.	73128334.	79571583.
		PARAMETERS			
#OF STUDNT	25000.	25000.	25000.	25750.	27038.
#OF EMPLYS	5000.	5000.	5000.	5000.	5000.
#OF SQ.FT.	8000000.	8000001.	8000002.	8000002.	8000003.
OTHER P.P.	1.0	.9	.8	.7	.8

Figure 2.

Summary Display of the Administrative Model.

METHOD

The primary objective in designing UMASS was ease of operation, rapid response and utmost flexibility. Elaborate calculations, extreme detail and fancy reports were secondary relative to the above criteria. Since the administrator who makes budgetary decisions for larger units is not interested in minute detail the system was designed with only the necessary detail involved. The typical sequence of events consists of the following steps:

1). Enter data by departments

2) Modify data or projections either by individual units or by aggregates

3). Run model

4). Display selected reports

5). Repeat sequence from step 2.

ILLUSTRATIONS

Following are conceptual representations of the structure and manipulation of the data in the model.

Figure 3 represents the creation of the initial data base. The two dimensional array of variables and planning parameters when applied to the two dimensional array of variables and departments creates the initial data base which is a three dimensional matrix of variables, departments and periods.

Figure 4 represents the data base where upon the selection of a department and a variable, the planning parameters, can be modified individually.

Figure 5 represents the data base where the "multiplier" array is applied to it. The "multiplier" array consists of a unity array (all values are 1). However values can be modified by the user. This allows modification of any single variable for all departments for all periods and acts as a secondary overall change of the planning parameters after individual departmental values have been modified.

As stated above the thus created data base is always saved for one iteration so that in the next run, one can modify the last data base according to figures 4 and 5 as many times as necessary.

Figure 6 represents the way displays are created in the administrative model, where the data base is three dimensional. (The academic model acts in exactly the same fashion except in four dimensions.) By

selecting a variable (or two variables) the remaining two dimensional array is displayed. The displays therefore allow all possible comparisons of any pair of variables on one page.

Figure 7 shows display type 1 of the administrative model. The display is the table of values of Variables by Units for the period chosen after the display has been selected.

Figure 8 shows display type 2 of the administrative model also. The display is the table of values of Variables by Periods for a unit selected from the ones on file.

Figure 9 shows display type 3 of the same model. The display is the table of values Units by Periods for a variable selected from the ones applicable.

Lack of space prevents the inclusion of displays of the academic model where 6 types exist since the data base is 4 dimensional.

CONCLUSION

The model described above has been operational for the last six months at the University of Massachusetts. Its acceptance was helped by the fact that data is readily available and results are easily understandable. As managers become more and more accustomed to using computers in forecasting budgets, tools similar to this model will become more and more widely used.

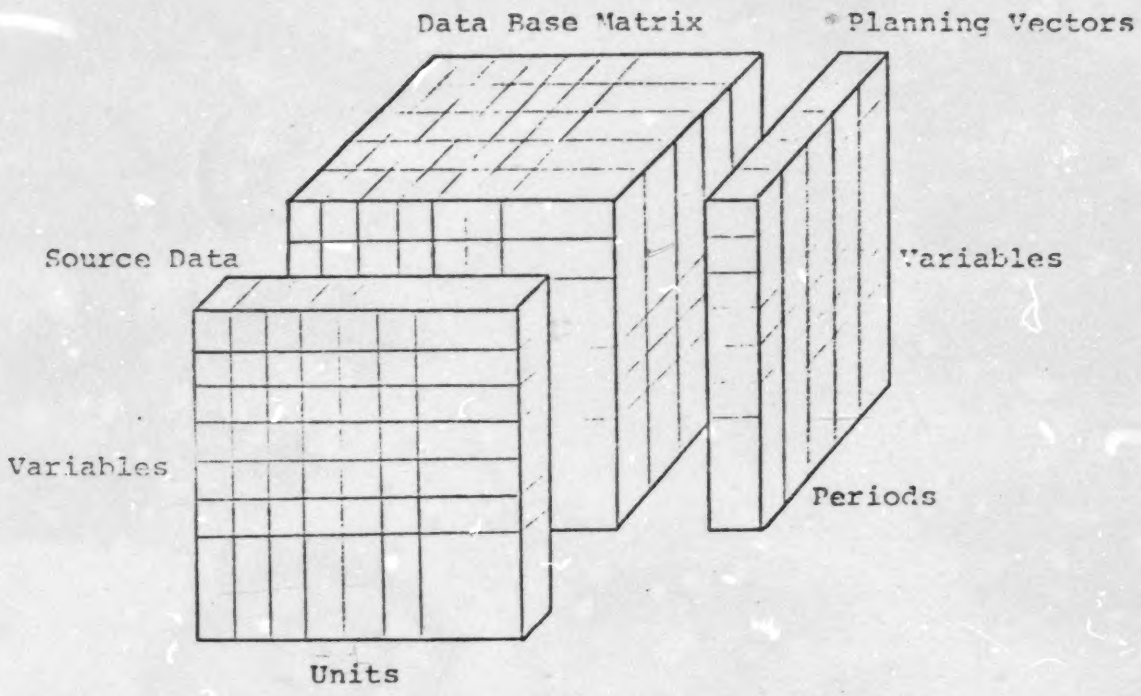
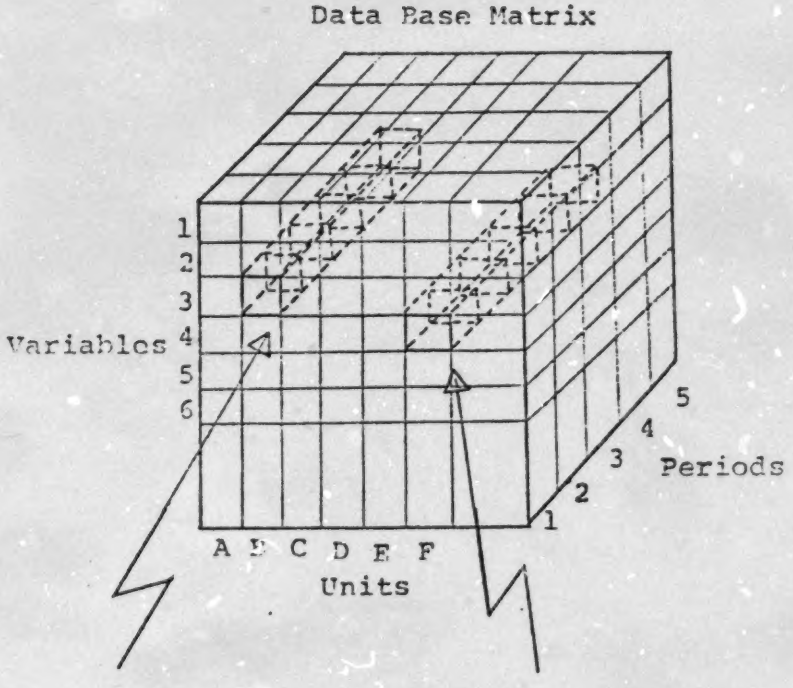


Figure 3.

Conceptual Representation of the Data Base Matrix
as Created by the Source Data Array
and the Planning Vectors.



Planning Vectors for Variable 3 and Unit B and Variable 4 and Unit F are Modified.

Figure 4.

Conceptual Representation of Modifications of the Individual Planning Vectors.

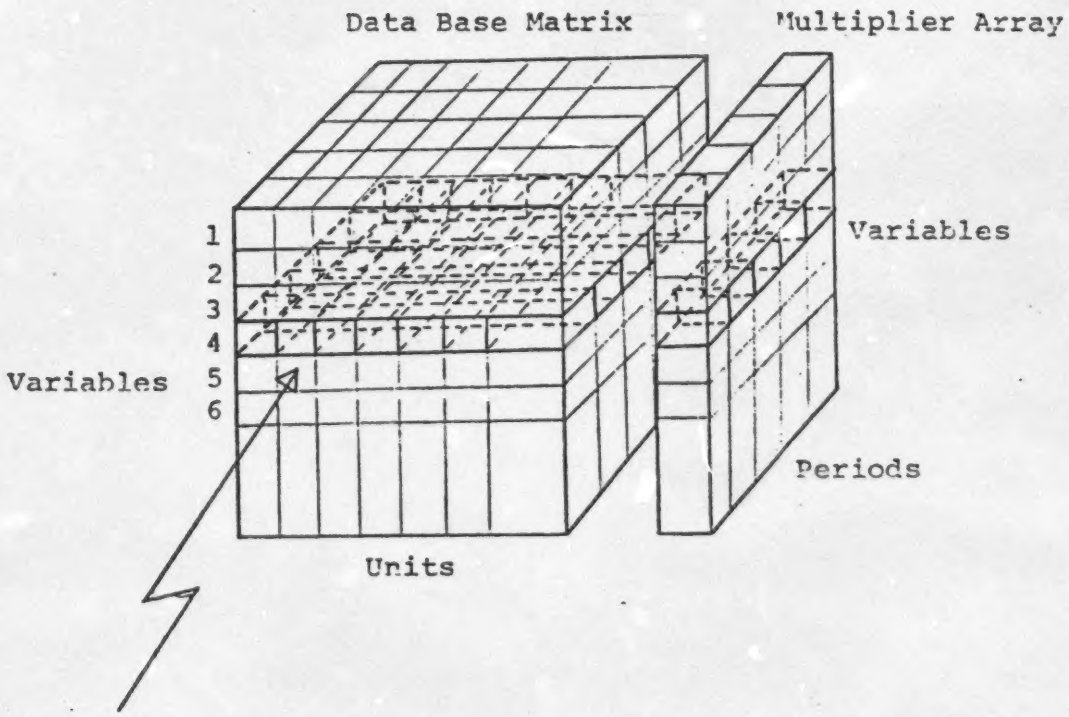


Figure 5.

Conceptual Representation of Modifications of the Multipliers.

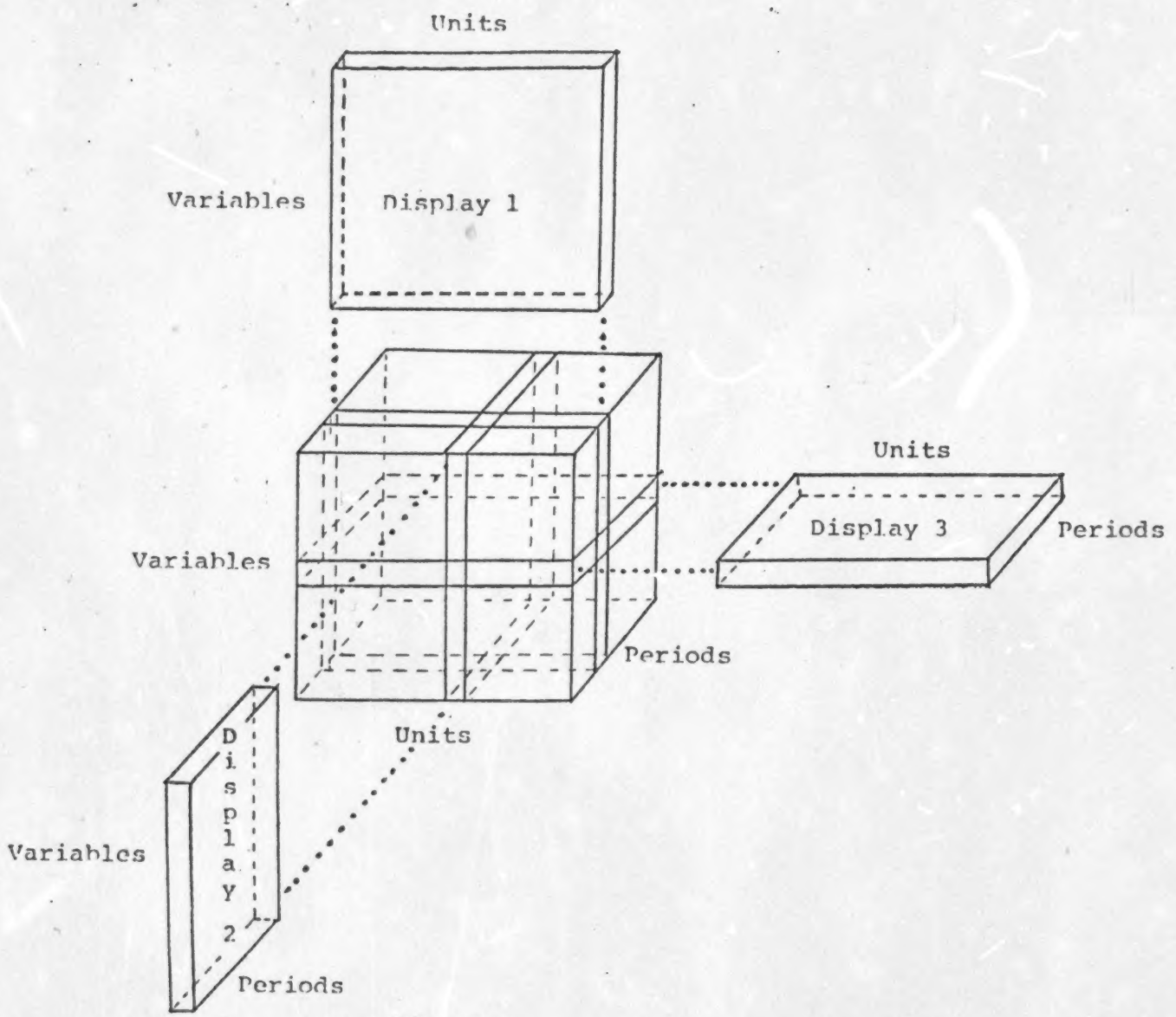


Figure 6.
Conceptual Representation of the Results Matrix and the Display Tables.

```
DISPLAY   1        2        3
        UNITS    PERIODS  PERIODS
        ------   -------  -------
        V I  I   V I  I   U I  I
        A I  I   A I  I   N I  I
        R I  I   R I  I   I I  I
        I I  I   I I  I   T I  I
        A I  I   A I  I       -------
        B I  I   B I  I
        L I  I   L I  I
        E I  I   E I  I
        ------   -------

TO TERMINATE - TYPE 4
? 1
WHICH PERIOD ? (1 THRU 5.
? 1


DISPLAY    1
CAMPUS     AMHERST
PERIOD     1974-75
```

UNITS	UCC ADP N-RES PRGS PUB SERVIC	LIB & A.V. ALUM OFF HOUSING ACADEMIC	FN ART CT PATR/TRANS PUB SAFETY PRES-AMHST	UNI PRESS SCHED OFF ADM/RECORD ORL	CCEBS FAC SEN ENVR HLTH FINAN AID	BLK CUL CT DAY CARE PER/FINAN DEANS	ATHLETICS VICE-CHANC ADMIN SUP PROVOST	CHANCELLOR UMS TRANS SECT	PUB AFFRS STU ACTIV PHYS PLANT	OBIS STU DEV CT RESEARCH
VARIABLE										
NUMBER OF PERSONNEL										
FACULTY	5.0	.0	1.0	.0	.0	.0	6.0	2.5	1.0	.0
	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
	.0	.0	.0	.0	.0	.0	.0	.0	.0	38.8
	39.4	1439.1	1.0	1.0	.0	24.5	10.9			
PROFESSNL	5.0	62.0	3.5	.0	1.0	1.0	24.0	21.5	20.7	18.5
	1.0	3.0	1.0	2.0	.0	.0	13.0	.0	.0	11.0
	2.0	1.0	4.0	12.0	3.0	19.0	1.0	1.0	44.0	3.2
	12.1	36.3	19.7	25.0	3.0	25.9	14.1			
CLERICAL	5.0	128.0	.0	.0	.0	.0	3.0	9.0	10.5	13.0
	32.0	4.0	.0	4.0	1.0	.0	0.0	1.0	.0	10.0
	1.0	2.0	77.0	32.0	3.0	20.0	33.0	.0	16.0	78.0
	96.0	406.1	21.0	17.0	5.0	77.7	10.0			
TECHNICAL	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
	.0	.0	.0	.0	.0	.0	.0	23.0	658.0	.0
	.0	.0	.0	.0	.0	.0	.0			
AVG. ANNUAL SALARY										
FACULTY	17575.	0.	16000.	0.	0.	0.	21632.	25862.	17309.	0.
	0.	0.	0.	0.	0.	0.	0.	0.	0.	-0.
	0.	0.	0.	0.	0.	0.	0.	0.	0.	23702.
	22733.	20922.	37758.	25750.	0.	18006.	21725.			
PROFESSNL	22523.	15252.	21581.	0.	14000.	12500.	18909.	19370.	16059.	18046.
	20754.	14337.	19116.	21467.	0.	0.	19154.	0.	0.	13583.
	16160.	12529.	18322.	16000.	18619.	19124.	17075.	14000.	16147.	29747.
	17692.	17473.	20021.	13936.	19005.	25274.	24589.			
CLERICAL	9213.	7710.	0.	0.	0.	0.	5899.	7599.	7166.	9373.
	9754.	7056.	0.	7557.	6237.	0.	3277.	6357.	0.	6251.
	5217.	9126.	8997.	6045.	8967.	8329.	8509.	0.	7003.	7013.
	7793.	7896.	6937.	7594.	6003.	7857.	6341.			
TECHNICAL	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	0.	0.	0.	0.	0.	0.	0.	8941.	8635.	0.
	0.	0.	0.	0.	0.	0.	0.			
PAYROLL COSTS										
FACULTY	88391.	0.	16000.	0.	0.	0.	129795.	64655.	17309.	0.
	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	0.	0.	0.	0.	0.	0.	0.	0.	0.	911877.
	895097.	30109075.	37758.	25750.	0.	463194.	236806.			
PROFESSNL	114138.	945613.	53052.	0.	14000.	12500.	455902.	416455.	332428.	333954.
	20754.	20794.	19116.	42934.	0.	0.	249027.	0.	0.	207709.
	32339.	12530.	73314.	203525.	55857.	363348.	17075.	14000.	710469.	95191.
	214770.	854270.	394411.	348410.	57015.	654592.	351623.			
CLERICAL	46049.	926330.	0.	0.	0.	0.	20696.	68363.	75242.	121952.
	312114.	30033.	0.	30228.	6237.	0.	49060.	6357.	0.	62514.
	5217.	18252.	692015.	222232.	26902.	749642.	331835.	0.	112047.	601431.
	748604.	3202587.	145806.	120000.	33414.	610458.	63425.			
TECHNICAL	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	0.	0.	0.	0.	0.	0.	0.	205047.	5681985.	0.
	0.	0.	0.	0.	0.	0.	0.			
$ COSTS										
03 $	40999.	157861.	6362.	0.	109200.	15960.	0.	57055.	70153.	53230.
	14743.	14830.	103835.	18000.	8500.	22500.	110000.	38175.	11000.	28122.
	7600.	13730.	3500.	8500.	17150.	68208.	43066.	0.	159320.	39271.
	14575.	3229454.	69303.	340862.	60505.	242841.	126499.			
04-09 $	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	0.	0.	14834.	0.	0.	2910.	0.	0.	3530600.	5200.
	0.	73321.	0.	0.	0.	17056.	0.			
10-16 $	346381.	170356.	30830.	0.	15000.	3475.	0.	73722.	132200.	40736.
	524073.	27047.	8000.	5270.	5245.	0.	87984.	1355.	0.	23470.
	392370.	6425.	31600.	81720.	3720.	122021.	59702.	0.	1082403.	103374.
	20235.	1673022.	59052.	45542.	231304.	362372.	81379.			
TOT.PROF.$	203539.	945613.	59052.	0.	14000.	12500.	455902.	481110.	349737.	333954.
	20754.	20794.	19116.	42934.	0.	0.	249027.	0.	0.	207709.
	32339.	12530.	73314.	203525.	55857.	363348.	17075.	14000.	710469.	1007268.
	1192767.	3074349.	432260.	374100.	97015.	1117788.	588429.			
TOT.CLAS.$	46049.	926330.	0.	0.	0.	0.	20696.	68363.	75242.	121952.
	312114.	30033.	0.	30228.	6237.	0.	49060.	6357.	0.	62514.
	5217.	18252.	692015.	222232.	26902.	749642.	331835.	205047.	5794032.	601431.
	748604.	3202587.	145806.	120000.	33414.	610458.	63425.			
TOT.PERS.$	248613.	857043.	69852.	0	14000.	12500.	620450.	549593.	424979.	455706.
	332853.	50827.	19116.	73162.	6237.	0.	298087.	6357.	0.	270223.
	38256.	20772.	705329.	425727.	82751.	1112000.	343710.	219647.	8504561.	1608498.
	1458431.	3394958.	577855.	507458.	20979.	1728242.	651854.			
TOT.OTHR.$	335338.	334217.	372804	0.	205200.	19439.	0.	130777.	202353.	94016.
	533216.	42437.	111205.	23076.	13265.	22500.	107099.	37530.	11000.	51522.
	399970.	20210.	50000.	39250.	20779.	130145.	83228.	0.	4752823.	147045.
	35466.	4900302.	130251.	326427.	291700.	622316.	207828.			
TOTAL $	633908.	2220160.	107150	0.	219200.	31939.	666459.	680280.	627332.	549722.
	871634.	101014.	13100..	97138.	20044.	22500.	405777.	43827.	11000.	321745.
	432236.	20957.	815.29.	515077.	103279.	1212115.	442738.	219647.	13257324.	1756344.
	1838291.	3834758.	703110.	809715.	342221.	2350558.	859742.			

Figure 7.

```
WHICH DISPLAY ?
1 - VARIABLES-BY-UNITS
2 - VARIABLES-BY-PERIODS
3 - UNITS-BY-PERIODS
4 - T E R M I N A T E

? 2
WHICH UNIT ?
   UNIT
NO.   NAME
---------------
  1  UCC
  2  LIB & A.V.
  3  FN ART CT
  4  UM PRESS
  5  CCEBS
  6  BLK CUL CT
  7  ATHLETICS
  8  CHANCELLOR
  9  PUB AFFRS
 10  OBIS
 11  ASP
 12  ALUM OFF
 13  PARK/TRANS
 14  SCHED OFF
 15  FAC SEN
 16  DAY CARE
 17  VICE-CHANC
 18  UHS
 19  STU ACTIV
 20  STU DEV CT
 21  H-IES PRGS
 22  HOUSING
 23  PUB SAFETY
 24  ADM/RECORD
 25  ENVR HLTH
 26  PER/FINAN
 27  ADMIN SUP
 28  TEACHG SECT
 29  PHYS PLANT
 30  RESEARCH
 31  PUB SERVIC
 32  ACADEMIC
 33  PRES-ADMIST
 34  ORL
 35  FINAN AID
 36  DEANS
 37  PROVOST
 40  AMHERST
? 10


DISPLAY     2
CAMPUS      AMHERST
UNIT        OBIS

PERIODS     1974-75    1975-76    1976-77    1977-78    1978-79
VARIABLE  |----------|----------|----------|----------|----------|----------|----------|----------|----------|
NUMBER OF PERSONNEL
******************
FACULTY           .0         .0         .0         .0         .0
PROFESSNL       13.5       13.5       13.5       13.5       13.5
CLERICAL        13.0       13.0       13.0       13.0       13.0
TECHNICAL         .0         .0         .0         .0         .0
AVG. ANNUAL SALARY
******************
FACULTY           0.         0.         0.         0.         0.
PROFESSNL     13046.     16242.     18018.     19589.     19497.
CLERICAL       9373.      9436.      9364.      9645.     10127.
TECHNICAL         0.         0.         0.         0.         0.
PAYROLL COSTS
*************
FACULTY           0.         0.         0.         0.         0.
PROFESSNL    333854.    300469.    333520.    343526.    360702.
CLERICAL     121852.    109907.    121730.    125382.    131651.
TECHNICAL         0.         0.         0.         0.         0.
$ COSTS
*******
 03 $         53230.     47952.     53227.     54824.     57565.
 04-09 $          0.         0.         0.         0.         0.
 10-16 $      40736.     36662.     40695.     41916.     44023.
TOT.PROF.$   333354.    300469.    333520.    343526.    360702.
TOT.CLAS.$   121352.    109907.    121730.    125382.    131651.
TOT.PERS.$   455706.    410135.    455250.    468908.    492354.
TOT.OTH.$     94016.     84614.     93923.     96740.    101577.
 TOTAL $     549722.    494750.    549173.    565648.    593930.
```

Figure 8.

```
WHICH DISPLAY ?
1 - VARIABLES-BY-UNITS
2 - VARIABLES-BY-PERIODS
3 - UNITS-BY-PERIODS
4 - T E R M I N A T E

? 3
WHICH VARIABLE ?
 VARIABLE
NO.   NAME
---------------
NO.OF
  1  FACULTY
  2  PROFESSNL
  3  CLERICAL
  4  TECHNICAL
AVG.SALARY OF
  5  FACULTY
  6  PROFESSNL
  7  CLERICAL
  8  TECHNICAL
PAYROLL COSTS
  9  FACULTY
 10  PROFESSNL
 11  CLERICAL
 12  TECHNICAL
$ COSTS
 13    03 $
 14    04-09 $
 15    10-16 $
 16  TOT.PROF.$
 17  TOT.CLAS.$
 18  TOT.PERS.$
 19  TOT.OTHR.$
 20   TOTAL $
? 18


DISPLAY     3
CAMPUS      AMHERST
VARIABLE    TOT.PERS.$

PERIODS   1974-75    1975-76    1976-77    1977-78    1978-79
UNIT      ---------- ---------- ---------- ---------- ----------

UCC           248618.    223756.    248369.    283495.    290504.
LIB & A.V.   1871943.   2004749.   1870072.   1933960.   2137316.
FN ART CT      69852.     62957.     69582.     74133.     81737.
UM PRESS           0.         0.         0.         0.         0.
CCEBS          14088.     12688.     13986.     14838.     16359.
BLK CUL CT     12588.     11250.     12488.     13243.     14606.
ATHLETICS     806459.    545813.    805853.    842749.    788631.
CHANCELLOR    549503.    494553.    548754.    565422.    593594.
PUB AFFRS     424979.    382481.    424554.    437291.    450156.
ORIS          455706.    410135.    455250.    462978.    482354.
ADP           332368.    299581.    332535.    342511.    350637.
ALUM OFF       59427.     53484.     59363.     61149.     64206.
PARK/TRANS     18118.     17204.     19097.     19676.     20653.
SCHED OFF      73162.     65846.     73083.     75282.     79046.
FAC SEN         6957.      6243.      6930.      7133.      7485.
DAY CARE           0.         0.         0.         0.         0.
VICE-CHANC    292637.    268818.    292388.    307348.    322797.
UHS             6357.      5721.      6371.      6737.      7428.
STU ACTIV          0.         0.         0.         0.         0.
STU DEV CT    270223.    243201.    269953.    285393.    315748.
N-RES PROG     38256.     34430.     38218.     40545.     44701.
HOUSING        30772.     27685.     30741.     32613.     35956.
PUB SAFETY    765329.    688796.    764564.    787501.    826876.
ADM/RECORD    425757.    383181.    425331.    438091.    459996.
ENVR HLTH      82759.     74483.     82676.     85157.     89414.
PER/FINAN    1112998.   1001691.   1111377.   1145234.   1202446.
ADMIN SUP     343918.    314819.    343561.    359018.    376969.
TRANS SECT    219647.    197682.    219427.    226010.    237311.
PHYS PLANT   6506501.   5854052.   6497999.   6692940.   7027587.
RESEARCH     1608409.   1302884.   1301582.   1205567.   1256895.
PUB SERVIC   1454431.   1595329.   1593224.   1394046.   1463748.
ACADEMIC    33945936.  30551349.  33912004.  35077252.  39464922.
PRES-ASSIST   577855.    520070.    577277.    594590.    624326.
GRL           503258.    452932.    502755.    533373.    538044.
FINAN AID      90429.     81386.     90339.     92840.     105664.
DEANS        1728242.   1555418.   1726514.   1831080.   2019185.
PROVOST       651854.    586669.    651232.    690861.    781674.
```

Figure 9.
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